Arthropoda.—M. Nussbaum has seen two polar globules in the cirripede egg (*Zool. Anzeiger, 301*). The first is formed while the egg is in the ovary, the second after fertilization in the egg sac.

Vertebrata.—Dr. R. W. Shufeldt publishes (*Journal Comp. Med. and Surg.*, Apr. 1889), an account of the osteology of the hawk, *Circus hudsonius*.

Mr. S. Garman (Bulletin Essex Institute, XX.), has collated the references to the Batrachia in the various editions of Kalm's Travels in North America. The result is to overturn some of the nomenclature of our frogs and toads.

EMBRYOLOGY.

Homologues in Embryo Hemiptera of the Appendages to the First Abdominal Segment of other Insect Embryos.—While preparing a paper on the appendages of the first abdominal segment of the embryo *Blatta germanica* for the Proceedings of the Wisconsin Academy of Sciences, Arts and Letters, to be published during the coming summer, my attention was drawn to the Hemiptera, on which no observations have as yet been made in regard to appendages to the first abdominal segment. The pair of appendages which appear on this segment in embryo Orthoptera, Coleoptera and Trichoptera remain short, but become bulbous, and persist in some cases till the larva hatches. All investigators agree that in these three orders the curious appendages reach their greatest development during the revolution of the embryo. They have been regarded by Rathke, Ayers, and Graber as embryonic gills, by Patten and myself as glands.

The two species examined by me were *Cicada septemdecim* and *Nepa cinerea*, which represent two of the three large divisions of the Hemiptera.

In both cases the appendages persist as in the Orthoptera till after revolution, but instead of being *e*vaginated as in the insect embryos heretofore investigated, they are *in*vaginated. The shape of one of these appendages is bulbous, and its pyramidal cells are radially arranged with their broader basal ends turned inwards and their tapering outer ends terminating on the surface of the body. In *Cicada* there are few cells in the organ, in *Nepa* a much greater number.

In *Cicada* a glairy, much vacuolated mass is secreted by the tapering outer ends of the cells, and projects into the space between the body

of the embryo and the egg envelopes. This space is filled with the coarsely granular secretion which before revolution filled the cavity of the amnion. The glairy secretion of the invaginated appendage stains pink in borax-carmine, and is distinctly marked off from the amniotic secretion.

In *Nepa* the secretion of the pyramidal cells differs from that in *Cicada* in a remarkable manner. The tapering ends of the cells are very delicate and transparent, and the secretion from the tip of each cell is not confluent with the secretion from the neighboring cells to form a glairy mass as in *Cicada*, but assumes the shape of a thread fully as long as the cell which secretes it, and protrudes into the space between the body wall and the egg envelopes. As the secretion of each cell remains thus independent, the secretion of the whole organ strikingly resembles a brush or a bundle of cilia.

I conclude that the *in*vaginated bulbous bodies in the first abdominal segment of Hemiptera are the homologues of the *e*vaginated bulbous appendages in other insect embryos from the following facts:

1. These organs in Hemiptera are two in number, and appear only in the first abdominal segment, in positions held by the evaginated appendages in other insect embryos.

2. They are ectodermic in their origin, like the appendages in other insects.

3. They have the same shape and cytological structure as the evaginated appendages of the first abdominal segment in Orthoptera and Coleoptera.

It is obvious that the invaginated appendages of the Hemiptera could never have functioned as gills, and their complete similarity in minute structure to the protruding bulb-shaped or even lamellar abdominal appendages of embryo beetles is strong evidence against Graber's and Ayer's supposition that these organs are respiratory in the forms heretofore studied.

On the other hand the supposition of Patten and myself that these organs are glandular, receives strong confirmation from my observations as briefly given above. My observations also make more plausible the supposition that the lung hooks of scorpions and spiders are the homologues of evaginated appendages.

I reserve a more complete and illustrated description of my results for future publication.—W. M. WHEELER, *Public Museum, Milwaukee.*

Observations on the Placentation of the Cat.—The following preliminary notes are offered in advance of the publication of an illustrated paper on the same subject.

The stages studied were from three days after impregnation to maturity.

All sections were cut with the embryo *in situ*. In the earliest stage examined little or no swelling was noticeable on the external surface of the uterine cornu. Sections through the cornu showed that the presence of the egg had induced very great changes in the mucosa; the most noticeable change being its increased thickness. In the stages immediately following the mucosa with its glands is turned inwards at both poles of the cavity, forming heavy lips around each pole of the latter. A little later the cavity containing the embryo becomes barrel-shaped, but remains so only a short time. The uterine glands become contorted, and extend peripherally almost to the annular muscular coat. The swelling of the cornu seems to be greatest on the side opposite the mesometrium. This is probably due to the fact that at that point there is least resistance. The spherical fœtal membranes touch the mucosa in an annulus about the embryonic or blastedermic vesicle, as they must necessarily do on account of the form of the latter and the tube in which it lies. The poles of the embryonic vesicle which do not come in close contact with the mucosa are, however, very small during the early stages.

The rapid growth of the embryonic vesicle seemingly expands the cavity of the cornu, and as the cornu does not become enlarged beyond each pole of the vesicle the mucosa must necessarily touch the chorion at all points except over a very small area at each pole.

In the succeeding stages the glands become very glassy in appearance, and contractile muscular bands were noticed about each gland, their function probably being to force out the "uterine milk," or secretion for the nourishment of the embryo at this stage.

Later, when the velli of the permanent chorion are developed, the glands cease their activity, and are transformed into crypts to receive the velli of the chorion. The glands at the poles remain unchanged. Their axial ends are turned towards the embryonic vesicle. They retain their contorted or spiral form and vascular appearance. The contact of the chorion and mucosa at this early stage determines the size and position of the placental zone. The placental zone increases its diameter and width slightly, but it does not increase in width as fast as the cavity containing the embryo elongates. It reaches its maximum width at a time when the embryonic vesicle is about one inch in diameter and almost spherical in form. The axial ends of all the uterine glands, in the cavity containing the embryo, beginning with the earliest stages, are pushed *from* the mesometrium, and on

the side opposite the mesometrium they are much shorter. These facts can probably be explained as a result of the increase in size of the embryo, during which it meets with the least resistance at the free side of the cornu, the swelling consequently increasing more rapidly on that side, while the axial ends of the glands are drawn down from the mesometrium, and those on the free side of the cornu are compressed.

During the early stages the axis of the embryo lies transversely to the axis of the cornu, but when the uterine cornu reaches a diameter of about one and one-eighth inches the embryo changes its position, and remains with its axis parallel to the axis of the cornu; the ventral side of the embryo is toward the mesometrium. About this time the placental band or zone, at a point diametrically opposite the mesometrium, undergoes atrophy, which in the last stages almost severs the placental girdle as a groove in its inner face. In this attempt at a break in the continuity of the placental zone, the cat resembles the squirrel, in which, as Professor Ryder has shown, so much of the zone is atrophied that only a square piece of the original placenta remains.

The blood supply of the maternal portion of the placenta is very noticeable at this stage. The sides of the crypts are well supplied with very large capillaries, and supported on the inner ends of the crypt are large vessels carrying maternal blood, forming a vascular mesh-work through which the crypts open into the uterine cavity.

The peripheral ends of the uterine glands are not transformed into crypts, but seem to form a layer of spongy tissue, the decidua, and it is very probable that at parturition a portion of the degenerate epithelium of the crypts adheres to the muscular walls of the cornu, and reproduces the mucosa.

During the growth of the embryo the annular muscular band undergoes considerable change. Its fibres are turned from their normal direction, and run obliquely over the uterine dilatation. At the end of gestation the length of the uterine cornu is about twice that of the non-gravid uterus.

This study was conducted in the Biological Laboratory of the University of Pennsylvania, under the direction of Professor Ryder, to whom I would express my obligations for the valuable aid which he extended during its prosecution.—M. J. GREENMAN.

Mr. Hy. Orr (*Quart. Jour. Micr. Sci.*, Dec., 1888) gives some detailed observations on the development of *Amblystoma punctatum* (or *A. bicolor*) and of *Rana halecina* (or *R. palustris*), with special reference to the central nervous system, and with notes on the hypophysis, mouth and appendages, and skeleton of the head. The central nerve-system first appears as a transverse epiblastic thickening, continuous with paired elongated epiblastic dorsal thickenings. The first nerve-fibres of the brain appear on what was originally the internal surface of the primitive dorsal epiblastic thickenings. A subsequent development of nerve-fibres gives rise to a continuous ventral commissure and to the anterior and posterior commissures of the brain.

Mr. Orr considers the balancers of Amblystoma as external gills of the mandibular arch, which have become metamorphosed into embryonic organs of support.

PHYSIOLOGY.[1]

Heart-sounds.—The well known experiment of Ludwig and Dogiel, who, by excluding the blood from the heart and presumably throwing out of function the atrioventricular valves, still heard the first heart-sound, is interpreted as evidence of the preëminently muscular character of that sound. Krehl,[2] working in Ludwig's laboratory, finds yet stronger evidence of similar nature. Through the auricles he introduces a simple apparatus by which, at will, the atrioventricular valves may be held back against the cardiac walls, and thus thrown out of action or not interfered with. Observers, even physicians skilled in auscultation, are unable to perceive any differences, either in intensity or character, of the sound, whether the valves are in use or not. Bleeding the animal from the carotid does not interfere with the first sound until shortly before death, when the sound becomes feeble in accordance with the feeble beat of the heart. The experiments do not elucidate the question whether the heart-beat is a single twitch or a tetanus; if it be the former, the sound may easily be explained, as Ludwig himself has previously suggested, by the pulling or rubbing of the muscle fibres on each other. If the ventricular contractions be excluded, a distinct but feeble auricular sound is heard. This may doubtless explain the "galop-rhythm," which is characterized by the

[1] This Department is edited by Dr. Frederic S. Lee, Bryn Mawr College, Bryn Mawr, Pa.

[2] Du Bois Reymond's *Archiv*, 1889, p. 253.